



Computed Tomography

The purpose of structured education is to provide the opportunity for individuals to develop mastery of discipline-specific knowledge that, when coupled with selected clinical experiences, helps to document qualifications. The *Structured Education Requirements for Computed Tomography* is provided to assist candidates with these requirements.

Candidates for computed tomography certification and registration must document at least 16 hours of structured education¹. The activities must be earned within the 24-month period immediately prior to submission of an application for certification and registration. Structured education activities may be academic courses from an institution accredited by a mechanism recognized by the ARRT², CE opportunities approved by a RCEEM or RCEEM+, or a combination of the two.

Structured education documentation must include at least one CE credit or its equivalent in each content category listed below (i.e., Patient Care, Safety, Image Production, and Procedures). The remaining hours may be earned from any one or more of the content areas. Specific topics within each category are addressed in the content outline, which makes up the remaining pages of this document.

Content Category	Minimum Credit Hours
Patient Care (includes) <i>Patient Interactions and Management</i>	1
Safety (includes) <i>Radiation Safety and Dose</i>	1
Image Production (includes) <i>Image Formation</i> <i>Image Evaluation and Archiving</i>	1
Procedures (includes) <i>Head, Spine, and Musculoskeletal</i> <i>Neck and Chest</i> <i>Abdomen and Pelvis</i>	1
Total	16

Acceptable Examples:

Example 1	Example 2	Example 3
Patient Care – 3 hours Safety – 2 hours Image Production – 4 hours Procedures – 7 hours	Patient Care – 1 hour Safety – 1 hour Image Production – 1 hour Procedures – 13 hours	Patient Care – 1 hour Safety – 5 hours Image Production – 5 hours Procedures – 5 hours
TOTAL – 16 hours	TOTAL – 16 hours	TOTAL – 16 hours

¹. If there is a structured education requirement document with a newer effective date, you may either use the new document or continue to use this document if you have completed at least one educational activity prior to the effective date of the new version. For more information access the online clinical experience tool, where structured education is also reported.

². Activities meeting the definition of an approved academic course will be awarded credit at the rate of 12 CE credits for each academic **quarter** credit or 16 CE credits for each academic **semester** credit. See the ARRT *Continuing Education Requirements* document for additional information.



Patient Care

1. Patient Interactions and Management

- A. Patient Assessment and Preparation
 - 1. clinical history
 - 2. scheduling and screening
 - 3. education
 - 4. consent
 - 5. immobilization
 - 6. monitoring
 - a. level of consciousness
 - b. vital signs
 - c. heart rhythm and cardiac cycle
 - d. oximetry
 - 7. management of accessory medical devices
 - a. oxygen delivery systems
 - b. chest tubes
 - c. in-dwelling catheters
 - 8. lab values
 - a. renal function (*e.g., BUN, eGFR, creatinine)
 - b. other (e.g., d-dimer, LFT, INR)
 - 9. medications and dosage
 - a. current
 - b. pre-procedure medications (e.g., steroid, anti-anxiety)
 - c. post-procedure instructions (e.g., diabetic patient)
- B. Contrast Administration
 - 1. contrast media
 - a. ionic, nonionic
 - b. osmolarity
 - c. barium sulfate
 - d. water soluble (iodinated)
 - e. air
 - f. water
 - g. other
 - 2. special contrast considerations
 - a. contraindications
 - b. indications
 - c. pregnancy
 - d. lactation
 - e. dialysis patients

- 3. administration route and dose calculations
 - a. IV
 - b. oral
 - c. rectal
 - d. intrathecal
 - e. catheters (e.g., peripheral line, central line, PICC line)
 - f. other (e.g., stoma, intra-articular)
- 4. venipuncture
 - a. site selection
 - b. aseptic and sterile technique
 - c. documentation (e.g., site, amount, gauge, concentration, rate and number of attempts)
- 5. injection techniques
 - a. safety
 - b. manual
 - c. power injector options
 - 1. single or dual head
 - 2. single phase
 - 3. multi-phase
 - 4. flow rate
 - 5. timing bolus
 - 6. bolus tracking
- 6. post-procedure care
 - a. treatment of contrast extravasation
 - b. documentation
- 7. adverse reactions
 - a. recognition and assessment
 - b. treatment
 - c. documentation

* The abbreviation "e.g.," is used to indicate that examples are listed in parenthesis, but that it is not a complete list of all possibilities.



Safety

1. Radiation Safety and Dose

- A. Radiation Physics
 - 1. radiation interaction with matter
 - 2. acquisition (geometry)
 - 3. physical principles (attenuation)
- B. Radiation Protection
 - 1. minimizing patient exposure
 - a. kVp
 - b. mAs
 - c. pitch
 - d. collimation/beam width
 - e. multi-detector configuration
 - f. gating
 - 2. personnel protection
 - a. controlled access
 - b. education
 - 3. shielding
 - a. traditional (e.g., lead apron)
 - b. non-traditional (e.g., bismuth)
 - 4. dose measurement
 - a. CT dose index (CTDI)
 - b. dose length product (DLP)
 - c. documentation
 - 5. patient dose reduction and optimization
 - a. pediatric
 - b. adult
 - c. dose modulation techniques (e.g., SMART mA, auto mA, CARE dose, and SURE exposure)
 - d. iterative reconstruction
 - e. dose notification
 - f. dose alert



Image Production

1. Image Formation

- A. CT System Principles, Operation, and Components
 - 1. tube
 - a. x-ray production
 - b. warm-up procedures
 - 2. collimation/beam width
 - 3. generator
 - 4. detectors
 - a. detector configuration
 - b. detector collimation
 - 5. data acquisition system (DAS)
 - 6. computer and array processor
- B. Imaging Parameters and Data Acquisition
 - 1. parameters
 - a. kVp
 - b. mAs
 - c. pitch
 - d. acquisition thickness
 - e. x, y, z planes
 - f. scan field of view (SFOV)
 - 2. acquisition
 - a. axial/sequential
 - b. helical/spiral
 - c. volumetric
- C. Image Processing
 - 1. reconstruction
 - a. filtered backprojection reconstruction
 - b. iterative reconstruction
 - c. interpolation
 - d. reconstruction algorithm
 - e. raw data versus image data
 - f. prospective/retrospective reconstruction
 - g. reconstruction thickness
 - h. reconstruction interval
 - 2. post-processing
 - a. multi-planar reformation (MPR)
 - b. 3D rendering (MIP, SSD, VR)
 - c. quantitative analysis (e.g., distance, diameter, calcium scoring, ejection fraction)

2. Image Evaluation and Archiving

- A. Image Display
 - 1. pixel, voxel
 - 2. matrix
 - 3. image magnification
 - 4. display field of view (DFOV)
 - 5. window level, window width
 - 6. cine
 - 7. geometric distance or region of interest (ROI) (e.g., mean, standard deviation [SD])
- B. Image Quality
 - 1. spatial resolution
 - 2. contrast resolution
 - 3. temporal resolution
 - 4. noise and uniformity
 - 5. quality assurance and accreditation
 - 6. CT number (Hounsfield units)
 - 7. linearity
- C. Artifact Recognition and Reduction
 - 1. beam hardening or cupping
 - 2. partial volume averaging
 - 3. motion
 - 4. metallic
 - 5. edge gradient
 - 6. patient positioning (out-of-field)
 - 7. equipment induced
 - a. rings
 - b. streaks
 - c. tube arcing
 - d. cone beam
 - e. capping
- D. Informatics
 - 1. hard/electronic copy (e.g., DICOM file format)
 - 2. archive
 - 3. PACS and electronic medical record (EMR)
 - 4. security and confidentiality
 - 5. networking



Procedures

TYPE OF STUDY

1. Head, Spine, and Musculoskeletal

A. Head

1. temporal bones/internal auditory canal (IAC)
2. pituitary fossa
3. orbits
4. sinuses
5. maxillofacial and/or mandible
6. temporomandibular joint (TMJ)
7. base of skull
8. brain
9. cranium
10. brain perfusion

B. Spine

1. cervical
2. thoracic
3. lumbar
4. sacrum/coccyx
5. post myelography
6. discography

C. Musculoskeletal

1. upper extremity
2. lower extremity
3. bony pelvis and/or hips
4. shoulder and/or scapula
5. sternum and/or ribs
6. arthrography

FOCUS OF QUESTIONS

Questions about each of the studies listed on the left may focus on any of the following relevant factors:

Anatomy

- imaging planes
- pathological considerations/recognition
- protocol considerations
- patient considerations (e.g., pediatric, geriatric, bariatric)
- post-processing presentations
- landmarks

Contrast Media

- indications
- scan/prep delay
- effect on images

Additional Procedures

- vascular (CTA, CTV) (e.g., PE, dissection, runoff, venogram)
- biopsies
- drainage
- aspirations

(Procedures continue on the following page.)



Procedures (continued)

TYPE OF STUDY

2. Neck and Chest

- A. Neck
 - 1. larynx
 - 2. soft tissue neck
- B. Chest
 - 1. mediastinum
 - 2. lung
 - 3. heart
 - 4. airway
 - 5. low dose lung screening

3. Abdomen and Pelvis

- A. Abdomen
 - 1. liver
 - 2. biliary
 - 3. spleen
 - 4. pancreas
 - 5. adrenals
 - 6. kidneys and/or ureters
 - 7. GI tract
- B. Pelvis
 - 1. bladder
 - 2. colorectal
 - 3. reproductive organs

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